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A digital system to evaluate the canopy projection in some cherry, apricot, and nectarine cultivars

A.C. Butcaru, D.I. Dumitrașcu, C.A. Mihai, F. Stănică, E. Moisescu

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1.Introduction

Modern analysis methods offer new possibilities for understanding the fruit tree's interaction with the environment and its response to applied technology.
The **WinSCANOPY system** analyses tree canopy through indirect methods (image analysis).
This study aims to present the influence of the planting system on several canopy parameters in three stone fruit species: cherry, apricot, and nectarine.

- Foliar index, direct, diffuse, and total radiation were measured.
- At the same time, the canopy dynamic during a growing season in the analyzed species was monitored.
- Vertical Axis, Parallel-U, Trident, Drapeau Marchand, Mikado, Tatura Trellis, and simple Palmette were considered system plantings, and images were taken at all cardinal points three times daily.
- The results quantified the canopy projection for all experimental variants.

2. Materials and methods

Biological material – 3 stone fruit species:

Apricot: Parallel-U (Siret, Lady cot/M29C), Trident (Danubiu, Faralia/M29C), Mikado (CMBU), Simple Palmette (Fortuna), Drapel Marchand (Dacia)
Sweet cherry: Vertical Axis (Early Red), Trident (Ludovic/Mahaleb, Kordia/G6), Drapel Marchand (Burlat/Colt), Tatura trellis (Ulster/Mahaleb), Parallel-U (Aryana/Gi5),
Nectarine: Vertical axis **(**Nectareine/Adesoto), Parallel-U (Costin), Trident (Nectabelle/GF677)

The WinSCANOPY system that consists of:
(1) Image acquisition hardware consisting of a camera with a calibrated fisheye lens and optional accessories (self-leveling mount and remote control), and
(2) Computer programs consisting of WinSCANOPY (Mini, Reg, or Pro) for hemispheric and cover image analysis and XLScanopy for data visualization.

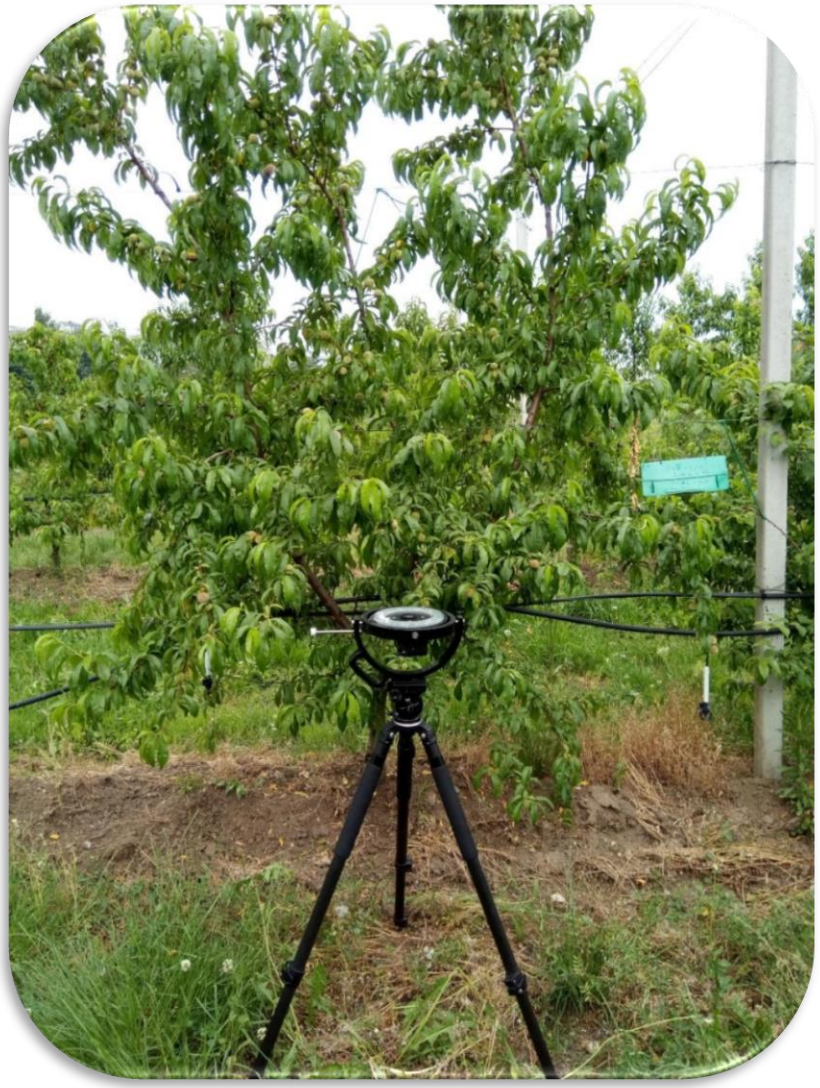
2. Materials and methods

Several series of photographs were analyzed with the WinSCANOPY software.

The photos were taken in the phenophase of intensive shoot growth, in **5 series** with repetition at ten-day intervals.

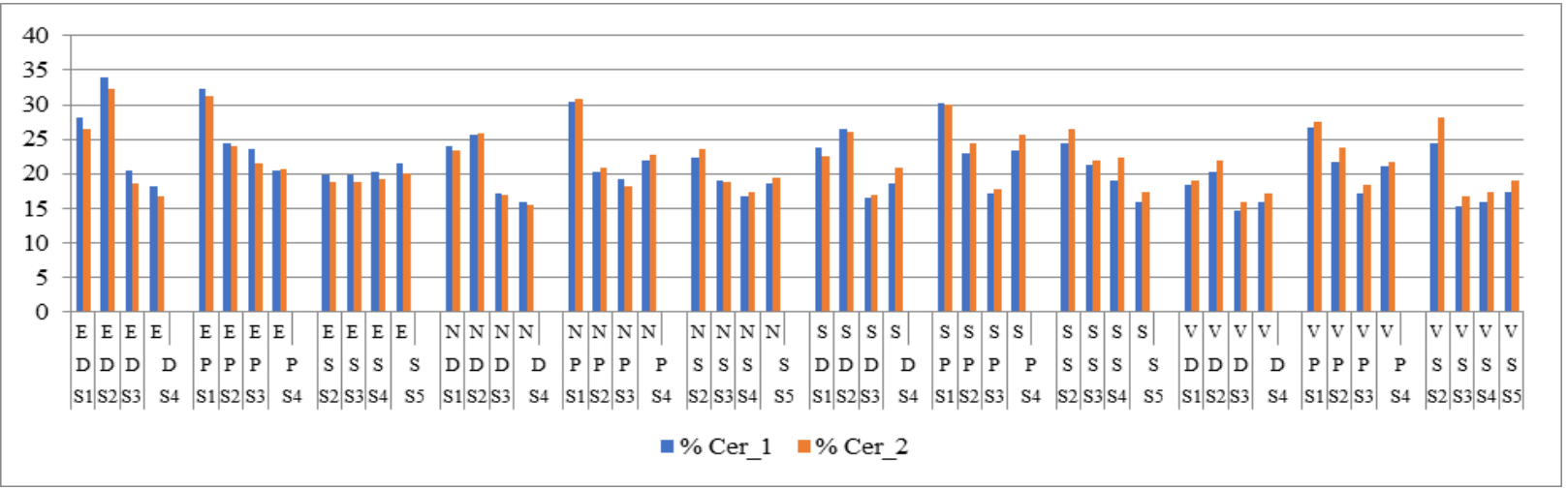
During the same day, **3 series of photos were taken**,
in the morning, around 9 am,
at noon, when the sun is at its zenith, around 2 pm, and
in the evening at 6 pm.

The trees were photographed (from bottom to top, 20 cm from the ground) from each cardinal point, resulting in a total of 60 pictures for each tree (**4 cardinal points** x 3 times of day x 5 evenings).

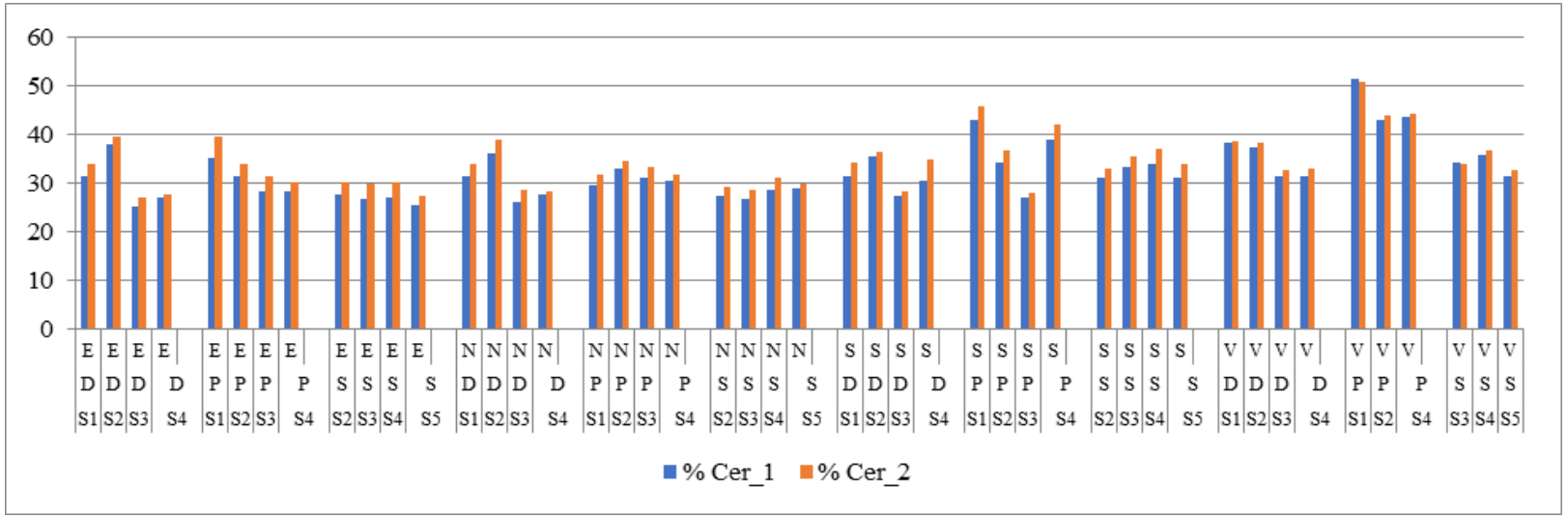


3. Results and discussion

The influence of species and planting system on crown projection at apricot (Trident)



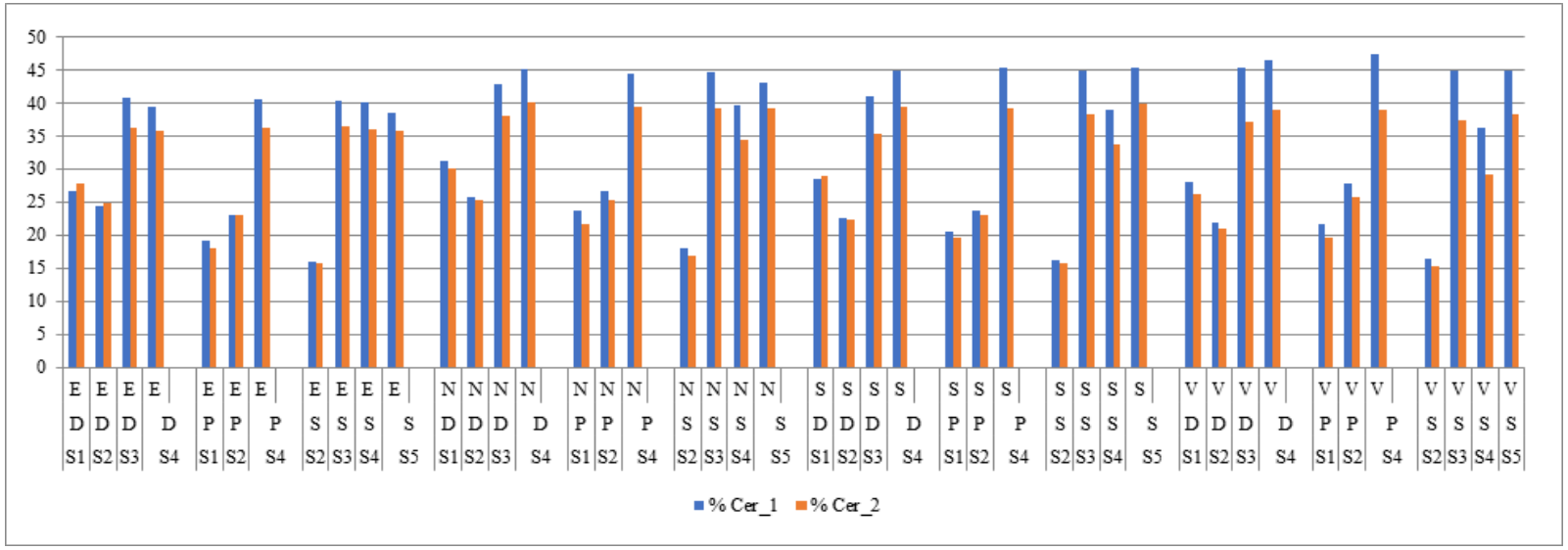
At an old tree, the values varied between 33.88% and 18.06% (East), 30.39% and 15.92% (North), 30.21% and 15.81% (South), and 26.76% and 14.56% (West).

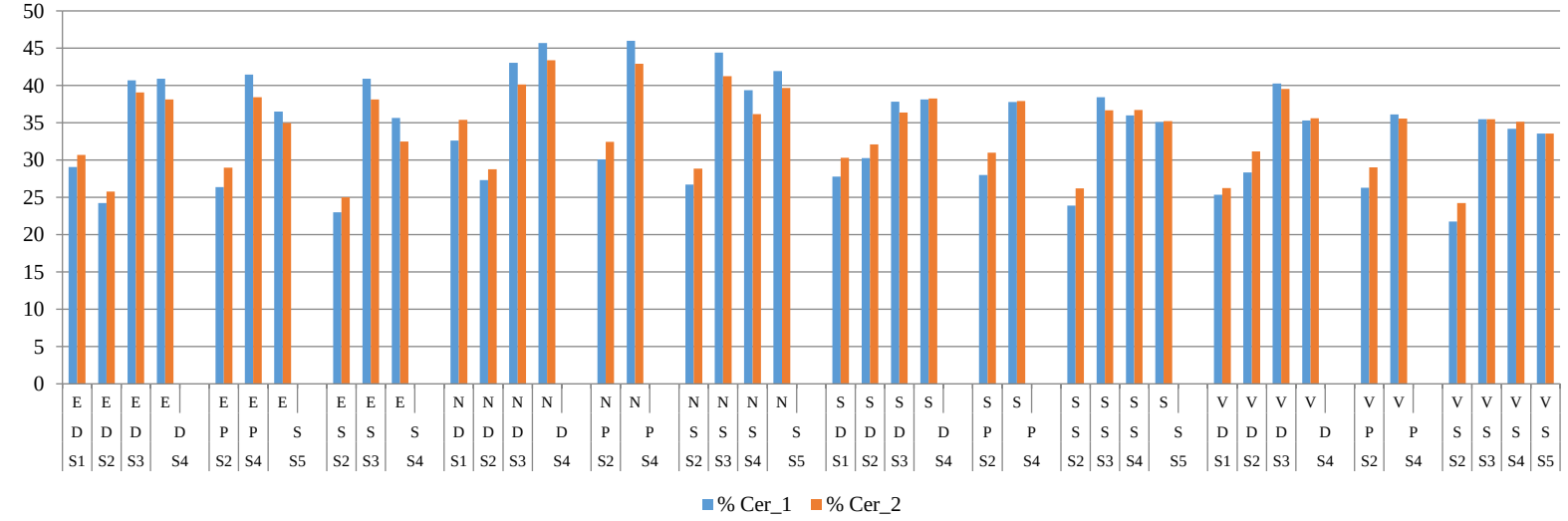


At the young tree, parameters varied between 38.0% and 25.24% (East), 36.13% and 26.08% (North), 43.15% and 27.05% (South), and 51.56% and 31.35% (West). It is observed that, compared to an old tree, a less developed canopy.

3. Results and discussion

The influence of species and planting system on crown projection at nectarine, Vertical Axis/Trident





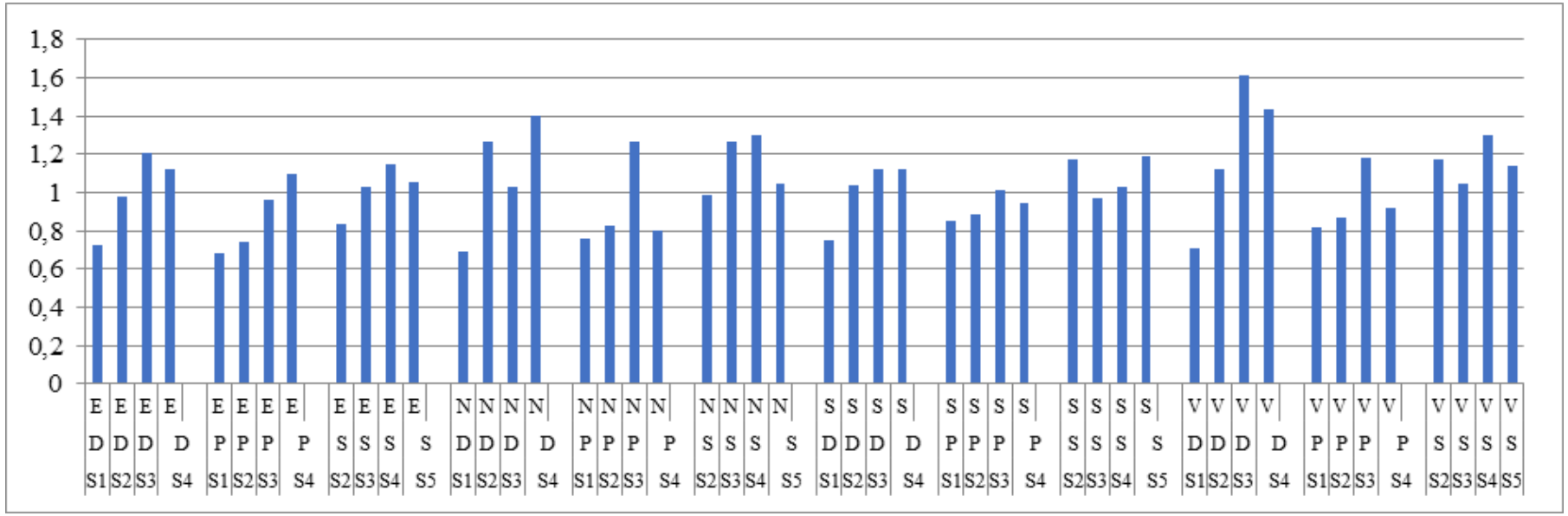
During the study, pruning was done at the Vertical Axes and Trident.

At the Vertical Axis, after pruning, the maximum values were 40,92% (East), 45,23% (North), 45,51% (South), and 47,58% (West).

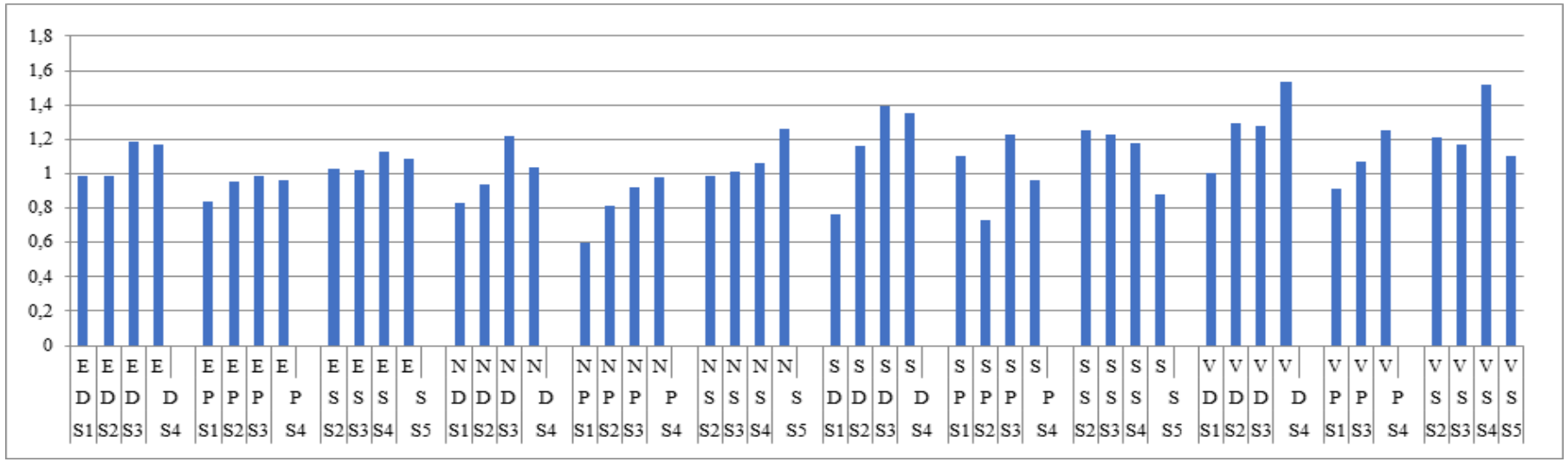
At the Trident, after pruning, the maximum values were 41,46% (East), 46% (North), 38,43% (South), and 40,25% (West).

3. Results and discussion

The influence of the species, the shape of the crown, and the orientation to the cardinal points on the leaf index at apricot (Drapel Marchand and Mikado system planting)



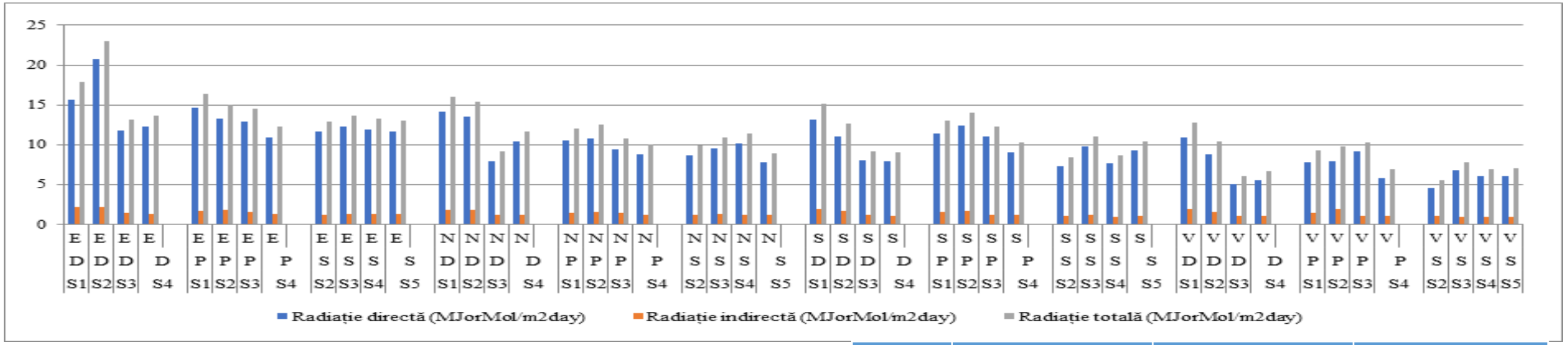
At the Drapel Marchand, the values for the ISF were 0.68-1.21 (East), 0.69-1.4 (North), 0.75-1.19 (South), and 0.71-1.61 (West).



Mikado canopy shape led to 0.84-1.19 (East), 0.6-1.26 (North), 0.73-1.39 (South), and 0.91-1.53 (West).

3. Results and discussion

The influence of species and crown shape on the level of direct and diffuse solar radiation at tree level at nectarine



Comparison between canopy shape – direct and diffuse solar radiation

Cardinal point	Vertical Axis		Bi-baum		Trident	
	Total radiation (MjorMol/m2day)		Total radiation (MjorMol/m2day)		Total radiation (MjorMol/m2day)	
	max	min	max	min	max	min
	direct%	diffuse%	direct%	diffuse%	direct%	diffuse%
East	24.69	7.1	23.01	12.35	17.78	7.2
	88	12	89	11	80	20
North	23.28	7.45	16	8.97	17.68	9.98
	86	14	88	12	84	16
South	20.18	6.86	15.14	8.42	19.99	6.28
	86	14	88	12	86	14
West	22.97	9.72	12.85	5.57	17.75	6.47
	87	13	85	15	86	14

4. Conclusion

Following the research carried out, we recommend the WinSCANOPY system as an extremely useful tool for monitoring crown parameters in fruit growing.

Apricot – Parallel- U canopy, series 1, in the morning

Thank you for your attention!

Contact

CS III.dr. Ana Cornelia BUTCARU

University of Agronomic Sciences and Veterinary Medicine of Bucharest

Bdul Mărăşti, 59, 011464, Bucureşti - ROMANIA

Phone: +40.733.520694

E-mail: ana.butcaru@qlab.usamv.ro

Home page: www.usamv.ro